UNITED STATES OF AMERICA

ENVIRONMENTAL PROTECTION AGENCY

STATE OF NEW HAMPSHIRE

PETITIONER,

V.

FOSSIL FUEL FIRED INDIRECT HEAT EXCHANGE COMBUSTION UNITS AND ELECTRIC GENERATING FACILITIES WHICH EMIT 10 TONS OF OXIDES OF NITROGEN (NOx) OR MORE PER DAY SITUATED IN THE STATES OF THE OZONE TRANSPORT REGION AND THE OZONE TRANSPORT ASSESSMENT GROUP SUBREGIONS 1-7

RESPONDENTS.

PETITION UNDER SECTION 126 OF THE CLEAN AIR ACT FOR ABATEMENT OF EXCESSIVE EMISSIONS

August 14, 1997

Table of Contents

List of Attachments

A. NHDES, Illustrative List of Upwind Sources Significantly Contributing to New Hampshire, August 1997.

B. OTAG Final Recommendations, June 1997.

C. OTAG AQA Workgroup Final Report, Vol. I: Executive Summary, "Telling the OTAG Story with Data," June 1997.

D. Clinton, Memorandum for the Administrator of the Environmental Protection Agency, "Implementation of Revised Air Quality Standards for Ozone and Particulate Matter," July 16, 1997; and,

USEPA, Office of Air and Radiation, "EPA's Revised Ozone Standard," July 17, 1997; and,

USEPA, Office of Air and Radiation, "EPA's Updated Clean Air Standards," July 16, 1997; and,

USEPA, Office of Air and Radiation, "Implementation of the Standards," June 25, 1997.

E. NHDES, List of New Hampshire 1-Hour Ozone Exceedances (30.125 ppm), August 1997.

F. NHDES, Monitored Ozone Concentrations (30.100 ppm), August 1997; and,

Sample Back Trajectory Plot, August 1997.

G. NESCAUM, "The Long-Range Transport of Ozone and Its Precursors in the Eastern United States," February 1997.

H. NHDES, New Hampshire Sample Hourly Ozone Plots for Nashua, August 1997.

I. Sonoma Technology, Inc., Earth Tech, "Initial Results on Transport and Mixing Based on NARSTO-Northeast Data," January 28, 1997.

J. NHDES, New Hampshire Sample Hourly Ozone Plot for Rye, August 1997; and,

Snapshot of Coastal Wind Patterns, August 1997.

K. Ferullo, "Critique of OTAG Model Performance Related to Ozone Transport into the Northeast," April 16, 1997.

L. Husar and Renard, "Ozone as a Function of Local Wind Direction and Wind Speed: Evidence of Local and Regional Transport," May 7, 1997.

M. Colburn, NHDES, "Apportioning Relative Culpability," May 14, 1997.

N. MacGillivray and Colburn, NHDES, "Assessment and Apportionment of Ozone Culpability," March 24, 1997.

O. NHDES, Percent Culpability Plots - July 1995 Episode, July 22, 1997.

List of Attachments
(continued)

P. Dorris, "Alternative Strategies for Reducing Ozone in OTAG: Who Contributes and Who Should Control Emissions," 1997.

Q. Rau, Mount, and Dorris, "Least Cost Options for Ozone Improvement in the Eastern United States, Estimating Emission Weights," June 18, 1997.

R. NHDES, Mt. Washington Monitor Data Summaries, August 1997.

S. OTAG NEMAC, Ozone Difference Plots (I - IN60 and I - IV60), May 1997.

T. NHDES, Ozone Exposure Plots (Base, Run 2, Round 3 Run I, IN60, IV60), May 1997.

U. Miller, NESCAUM, "An Approach to Estimating Downwind Ozone Contributions Based on OTAG UAM-V Subregional Modeling," August 4, 1997.

V. MADEP and MEDEP, Difference Plot, New England Domain for July 8, 1988 (New Hampshire VOC Emissions Zeroed-out).

W. Earth Tech, "Assessment of UAM-V Performance in Northeast Region for OTAG Episodes," March 1997.

X. STI, "Assessment of Transport and Mixing and OTAG Model Performance for Northeast U.S. Ozone Episodes, Summary of Results," March 31, 1997.

Y. OTAG, Round 2 Modeling, "Assessing the Role of Ozone Transport, Observational and Modeling Analysis," 1996.

Z. NHDES, Reactivity of Modeled Ozone Peak 1-Hour Concentration to Percent NOx Reduction, 1996.

AA. OTAG RUSM & ISI Workgroups, Map of OTAG Subregions, from "Geographic Sensitivity Modeling," Modeling, December 19, 1996.

AB. Nichols (EPA) Letter to Walls (NHDOJ), "Guidance on Section 126 Petitions," August 8, 1997.

AC. Colburn and MacGillivray, NHDES, "Answering the '2-6 ppb' Question: Do NOx Reductions Upwind Really Only Reduce Long-Range Transport That Little?,"
April 18, 1997.

Other References

Bluestein, "OTAG NOx Emissions," Memorandum to Brian McLean, May 21, 1997.

Shaw and Amar, “A Retrospective Look at the Costs of Controlling Air Pollution,” OTAG Meeting, Chicago, May 12-14, 1997.

E.H. Pechan & Associates, inc., “OTAG Cost Parameters Applied to Non-Utility Strategies to Reduce Ozone Transport,” May 29, 1997.

UNITED STATES OF AMERICA

ENVIRONMENTAL PROTECTION AGENCY

STATE OF NEW HAMPSHIRE

PETITIONER,

V.

FOSSIL FUEL FIRED INDIRECT HEAT EXCHANGE COMBUSTION UNITS AND ELECTRIC GENERATING FACILITIES WHICH EMIT 10 TONS OF OXIDES OF NITROGEN (NOx) OR MORE PER DAY SITUATED IN THE STATES OF THE OZONE TRANSPORT REGION AND THE OZONE TRANSPORT ASSESSMENT GROUP SUBREGIONS 1-7

RESPONDENTS.

PETITION UNDER SECTION 126 OF THE CLEAN AIR ACT FOR ABATEMENT OF EXCESSIVE EMISSIONS

A. Introduction

1. This is a petition under Section 126(b) of the Clean Air Act ("CAA"), 42 U.S.C. §7426, by the State of New Hampshire for a finding that a group of stationary sources comprised of all fossil fuel fired indirect heat exchange combustion units and all fossil fuel fired electric generating facilities which emit 10 tons of NOx or more per day in the States of the Ozone Transport Region and in the Ozone Transport Assessment Group Subregions 1 through 7 [1] (hereinafter "generating facilities") are emitting air pollutants in violation of Sections 110(a)(2)(D) and 126(c) of the CAA. The generating facilities which comprise this group of sources, and for which this finding is sought, include, but are not limited to, the sources identified in Attachment A to this petition.[2]

[1] Subregions 1 through 7 of the Ozone Transport Assessment Group include all or portions of the States of Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, Ohio, Virginia, West Virginia, and Wisconsin. These Subregions are illustrated in Attachment AA.

[2] The Petitioner has made every effort to identify boilers, other heat exchangers, and electric generating units which generate 10 tons of NOx of more per day, and in regions for which OTAG modeling was

2. Pursuant to Section 126(c) of the CAA, 42 U.S.C. §7426(c), the State of New Hampshire requests that the Administrator establish emission limitations for the generating facilities, which emission limits are no less stringent than (i) the Phase III NOx reductions established pursuant to the Memorandum of Understanding adopted by the Ozone Transport Commission on September 27, 1994 for boilers and other indirect heat exchange units with a maximum gross heat input rate of at least 250 million Btu/hour and/or (ii) the final recommendation of the Ozone Transport Assessment Group ("OTAG") of a reduction in NOx emissions of 85% from projected 2007 baseline emissions of utility sources, and/or (iii) an emission rate of 0.15 pounds per million Btu ("lb/mmBtu") for the generating facilities. This petition also seeks the establishment by the Administrator of a compliance schedule (including increments of progress) to ensure that the generating facilities comply with the new emission limitations as expeditiously as practicable. In establishing emission limits for electricity generating facilities, this petition also requests that the Administrator consider the adoption of limits which provide NOx reductions equivalent to a 0.15 lb/mmBtu limit, but which are based on generation output (in order to encourage production efficiency) rather than on heat input.

3. The State of New Hampshire is responsible under N.H. Revised Statutes Annotated ("RSA") 125-C for developing, implementing, and enforcing the State's implementation plan ("SIP") under Section 110 of the CAA, 42 U.S.C. §7410, and its non-attainment plans under Sections 172 and 182 of the CAA, 42 U.S.C. §§ 7502, 7511a, respectively. As described more fully hereinafter, the State has determined that it will be unable, or will be substantially impeded in its effort, to attain or maintain attainment with the National Ambient Air Quality Standard ("NAAQS") for ozone as the result of the significant contribution from the generating facilities identified in this petition of ozone and/or oxides of nitrogen ("NOx") which are transported into the State.

B. Factual Background

---

performed, for the United States Environmental Protection Agency ("EPA") to consider in evaluating the necessity for relief under this petition. To the extent that the Petitioner has omitted any source in this group of sources, or omitted sources which contribute significantly to ozone in New Hampshire from greater distances or under meteorological conditions other than those modeled by OTAG, such omission is unintentional and the Petitioner intends this petition to cover these sources and groups of sources as well.

4. The generating facilities emit large quantities of NOx as a byproduct of electricity generation, manufacturing, and/or other industrial operations. NOx reacts with volatile organic compounds ("VOCs") in the presence of sunlight to produce ground-level ozone. NOx and ozone produced as a result of NOx emissions by the generating plants are transported by prevailing winds to the State of New Hampshire, which causes or contributes to elevated levels of ozone and, from time to time, exceedances of the NAAQS for ozone.

5. In enacting amendments to the CAA in November of 1990, Congress established a classification system for ozone nonattainment areas. This classification system created marginal, moderate, serious, severe, and extreme ozone nonattainment designations based upon the amount by which a particular area exceeded the ozone NAAQS. The 1990 amendments also established mandatory SIP submission requirements based upon the ozone nonattainment designation. See §182, 42 U.S.C. §7511a. Control measures required of areas designated serious and above impose additional burdens on citizens and an economic development disadvantage in such areas. In addition, failure of the affected states to submit and implement the required SIP programs can result in the imposition of severe economic and monetary sanctions under the CAA. *See* §179, 42 U.S.C. §7509.

6. The 1990 amendments to the CAA explicitly recognize the regional nature of the ozone nonattainment problem in the northeastern United States. Under Section 184 of the CAA, there was established the Northeast Ozone Transport Region ("OTR") consisting of the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont and the District of Columbia. 42 U.S.C. §7511c(a). The CAA imposes on these states pollution control requirements greatly in excess of those imposed by the CAA on areas outside the OTR with the same nonattainment classification. In many cases, the emission threshold for major stationary sources of NOx and VOCs of one-hundred (100) tons per year was lowered within the OTR states to potential emissions of fifty (50) tons per year, and the OTR states are required to regulate mobile sources in certain areas through automobile inspection and maintenance programs. *See* Sections 184(b)(2) and 184(f)(1), 42 U.S.C. §§ 7511c(b)(2), 7511c(f)(1), respectively.

7. The OTR states have also adopted and have implemented reasonably available control technology ("RACT") requirements for all existing major sources of NOx and VOCs, new source review ("NSR") standards for major stationary sources, Stage I and Stage II vapor recovery programs for gasoline stations, and reformulated fuel requirements, often on a statewide basis. In many OTR states, low enhanced emission vehicles ("OTC LEV") and some form of automotive emissions inspection and maintenance ("I/M") programs are also required. The specific measures adopted by New Hampshire are described more fully hereinafter.

8. As a result of the realization by the OTR states that the pollution control measures required under the CAA would not be sufficient to achieve and maintain the NAAQS for ozone in the OTR, the states of the Ozone Transport Commission ("OTC") adopted on September 27, 1994 a Memorandum of Understanding ("MOU") which required reductions in NOx emissions by up to 65% from 1990 baseline emissions in the most heavily polluted portions of the OTR by 1999. Under the MOU, the OTR states also committed to adopting additional regulations by May 1, 2003 establishing a NOx emission rate of no greater than 0.15 lb/mmBtu or a 75% reduction from 1990 baseline emissions, whichever is less stringent (unless this additional reduction is demonstrated to be unnecessary).

9. Under Section 182(c)(2)(A), the OTR states, including New Hampshire, were obligated to file, by November 15, 1994, attainment demonstrations based upon photochemical grid modeling or its equivalent for the areas within their states classified as serious nonattainment. However, several states predicted exceedances of the NAAQS for ozone even when modeling was conducted with the EPA-approved Urban Airshed Model ("UAM") Version IV with all anthropogenic emissions within the domain set to zero. As a result, EPA provided states with an alternative for approval of their attainment demonstrations. One of the conditions of the alternate approval process was participation in a consultative forum to address regional pollution transport.

10. Consistent with a March 2, 1995 memorandum from EPA Assistant Administrator Mary Nichols which outlined this alternative process, OTAG was launched under the auspices of the Environmental Council of the States ("ECOS") to assess regional strategies to reduce ozone transport. OTAG's stated goal was to "identify and recommend a strategy to reduce transported ozone and its precursors

which, in combination with other measures, will enable attainment and maintenance of [the ozone NAAQS]." *See* OTAG, Final Recommendations, June 19-20, 1997, Attachment B, p. 1. OTAG included 37 states in the middle and eastern portions of the United States and representatives from EPA as well as various industry and environmental groups. New Hampshire participated extensively in this collaborative effort.

11. In its final report published in June 1997, OTAG did not specify any single approach for reducing NOx emissions from electric generating facilities. Rather, it recommended a range of utility NOx controls in the fine grid area falling between Clean Air Act controls and the less stringent of an 85% reduction from the 1990 baseline or a NOx emission rate of 0.15 lb/mmBtu in order to mitigate the transport of ozone and assist states in complying with the existing NAAQS. For non-utility NOx sources, OTAG recommended that the stringency of controls for large non-utility point sources should be established in a manner equitably with utility controls.

12. The State of New Hampshire believes that the successful implementation of the OTC MOU and the final OTAG recommendations will address the excessive NOx emissions currently being emitted by the generating facilities. In order to abate the transport of NOx emitted by the generating facilities into the Northeast, so as to prevent these transported emissions from significantly contributing to nonattainment within the State of New Hampshire, the Administrator should impose such NOx emissions limits upon the generating facilities identified in this petition which are at least as stringent as the Phase III limitations under the OTC MOU, and/or the final OTAG recommendations, and/or an emission rate of 0.15 lb/mmBtu.

C. The New Ozone NAAQS

13. On July 18, 1997, EPA issued a final rule establishing a new NAAQS for ozone. The new standard is 0.08 parts per million ("ppm") measured over eight (8) hours, which is to be implemented over time to replace the current standard of 0.12 ppm measured over one (1) hour. The OTAG Air Quality Analysis Workgroup ("AQA") of the Modeling and Assessment Subgroup concluded that "the 8-hour standard will result in significantly more nonattainment areas across the OTAG domain which will be closer together. This will make

ozone transport more critical with respect to nonattainment than it is under the current standard." OTAG Air Quality Analysis Workgroup Results Executive Summary, June 12, 1997. *See* Attachment C.

14. EPA has stated that no county will have to comply fully with the new NAAQS until at least 2004, and no new SIPs will be completed and approved until 2001 at the earliest. *See* Attachment D. Furthermore, the states remain obligated to complete the current SIP attainment demonstration in accordance with the 0.12 ppm NAAQS standard. Thus, this petition is limited to seeking a finding and the implementation of new emissions limitations upon the generating facilities based upon the current 0.12 ppm standard. New Hampshire believes that the future implementation of the new 0.08 ppm standard for ozone only increases the necessity for EPA to control ozone transport originating from the generating facilities.

D. Statutory Authority for Review

15. Section 126(b) of the CAA authorizes any state or political subdivision to petition the Administrator for a finding that any major source or group of stationary sources emits or would emit any air pollutant in violation of the prohibition of section 110(a)(2)(D)(ii). 42 U.S.C. §7426(b). Within sixty (60) days after the receipt of any such petition, and following a public hearing, the Administrator must enter a finding or deny the petition. Id.

16. If the Administrator finds that a source or group of sources is emitting a pollutant in violation of Section 110, the source must cease its operation within three months unless the Administrator permits the source to continue operating under such emission limits and compliance schedules required to achieve compliance with Section 110. 42 U.S.C. §7426(c)(2). Abatement of any violation of Section 110 must occur as expeditiously as possible, but no later than three (3) years following the issuance of the Administrator's finding. Id.

17. Section 110(a)(2)(D), in turn, requires each state implementation plan to contain provisions "prohibiting … any source or other type of emissions activity within the State from emitting any air pollutant in amounts which will (i) contribute significantly to nonattainment in, or interference with maintenance by,

any other State of any … [NAAQS]." Although a source or group of sources that violate the prohibition in Section 110(a)(2)(D) will necessarily be violating the SIP of the State in which it is located, Section 126 authorizes a petitioning state to request direct enforcement of the Section 110 prohibition.

E. New Hampshire's Attainment and Maintenance Status

I. New Hampshire Attainment Status

18. The 1990 amendments to the CAA established five ozone nonattainment categories with progressive levels of severity. Section 181, 42 U.S.C. §7511. In addition, attainment areas may be classified or unclassified according to the adequacy of monitoring data for such areas. The classifications assigned to the State in accordance with this scheme are as follows:

Nonattainment Areas

i. Serious Nonattainment: the New Hampshire portion of the Boston Consolidated Metropolitan Statistical Area ("CMSA"), comprising greater Nashua and Salem. Portsmouth-Dover-Rochester Metropolitan Statistical Area ("MSA"), including Strafford County and eastern Rockingham County.

ii. Marginal Nonattainment: Merrimack County. Portions of Hillsborough and Rockingham Counties (including much of greater Manchester) that are not included in the Serious Nonattainment areas.

iii. Non-Classifiable Nonattainment: Cheshire County.

Attainment Areas

iv. Classified Attainment**:** Coos County.

v. Unclassified Attainment: Belknap, Carroll, Grafton, and Sullivan Counties.

II. History of Ozone Exceedances in New Hampshire Since 1989

19. A list detailing all exceedances of the NAAQS standard for ozone under the existing standard (0.12 ppm) which have been recorded at New Hampshire air monitoring stations from April 1, 1989 to July 1, 1997 appears in Attachment E . For each exceedance, there are listed: the monitor location, date, maximum recorded hourly ozone value, hour of observation, wind direction in degrees at the time of maximum observations, wind speed in miles per hour at the time of maximum observation. Also included in this list for comparison is a compilation of maximum ozone values recorded at two other New Hampshire monitoring stations for the same date as the exceedance. The comparison data provides the same statistical parameters used for the ozone standard exceedances.

20. In summary, New Hampshire's air monitoring network has recorded 22 exceedances of the NAAQS standard for ozone on 18 different days from April 1989 to July 1997. Some 77% of these exceedances were recorded on New Hampshire's seacoast (Rye and Portsmouth). On nearly half of those occasions, the wind direction for the hour was out of the east-southeast (i.e., a sea breeze). These episodes resulted from the transport of ozone blown into the State from over the ocean. In 89% of the remaining episodes on the seacoast, the wind direction was from the south-southwest. Because New Hampshire's coastline is only 15 miles long and begins near the southern extreme of the state, ozone produced by emissions from New Hampshire sources would have to be blown directly from the west-northwest in order to be monitored on New Hampshire's seacoast. Monitoring data, however, demonstrates that ozone exceedances in New Hampshire rarely, if ever, occur with such wind directions. In every New Hampshire exceedance except one (in 1993), wind directions have possessed a significant southerly transport component.

21. Attachment F lists New Hampshire exceedances of hourly ozone concentrations greater than 120 parts per billion (“ppb”) and near exceedances (ozone concentrations greater than 100 ppb and less than 120 ppb) from April 1995 to July 1997. Each of these values are listed by site, date, maximum recorded ozone concentration in parts per million, the hour that the maximum value occurred, the number of hours that day that were at or over 100 parts per million, the wind direction in degrees at the time of maximum recorded ozone, and the wind speed in miles per hour at the time of maximum ozone.

22. Ozone levels exceeding 100 ppb have been recorded 35 times during the past two and one-half years on 21 different days. Some 57% of these occurred at New Hampshire's coastal air monitoring stations (43% at Rye, 14% at Portsmouth). Of those that were recorded inland, about 60% took place after 6 p.m. and in the presence of a persistent wind out of the south and southwest. Since the formation of ozone requires sunlight and heat, these elevated levels were a direct result of the transport of ozone produced earlier in upwind locations. Back trajectory analyses of these occurrences show that in each case the airmass traveled over northern New Jersey, metropolitan New York, Connecticut, and central Massachusetts before reaching New Hampshire. *See* Attachment C. In short, over 80% of these events can be directly attributed to transport from upwind area.

III. New Hampshire Emission Reduction Measures

23. New Hampshire has implemented several air quality programs, including VOC RACT, NOx RACT, and the OTC NOx MOU on a statewide basis. Stage I and Stage II gasoline vapor recovery have also been implemented statewide and in the four nonattainment counties, respectively. Reformulated gasoline ("RFG") has also been fully implemented in the four nonattainment counties. Though RFG is required in only four of New Hampshire's ten counties, the nature of the regional gasoline market has resulted in a consistent supply of RFG to most of the state. New Hampshire has also achieved emission reductions from federally implemented programs for new light-duty vehicles, consumer products and architectural coatings, and from the adoption of more stringent California vehicle standards (OTC LEV) by neighboring states. Over 75% of model year 1997 cars sold in New Hampshire comply with OTC LEV.

24. Through implementation of these programs, New Hampshire believes that it has met the overall emission reduction targets of the CAA. While New Hampshire disputes the ozone reduction benefit of VOC control measures applied in the State and believes that NOx emissions should be the target of any ozone control campaign, the State does acknowledge the accompanying human exposure and toxics emissions benefits of Stage I/II, RFG and consumer product and architectural coating requirements. The only program required by the CAA that New Hampshire has not implemented is enhanced vehicle I/M. As required by EPA, I/M is primarily a VOC reduction program which targets the light duty vehicle portion of the mobile source sector. New Hampshire, however, is considering a NOx-oriented Performance Safety and Screening Program

("PASS"), which the State believes could result in reductions of ozone far greater, and in a more cost effective manner, than the reductions which could be obtained from the CAA-mandated I/M program.

F. Factual Allegations Pertaining to the Transport of Air Pollution From Upwind Sources into New Hampshire and the Northeast

I. Patterns of Ozone and Ozone Precursors

a. Ozone Production

25. The formation and transport of ground level ozone is a complex phenomenon affected by several variables. Ozone is formed in the atmosphere when NOx combines with VOCs in the presence of sunlight. Consequently, solar energy, mixing conditions, and relative NOx and VOC concentrations within an airmass are paramount to ozone formation.

26. High pressure systems cause an airmass to flow downward, a phenomenon which increases ground level ozone concentrations in at least four ways: (1) the sinking motion of the airmass under high pressures stabilizes the airmass, reducing cloud formation and resulting in an increase in solar energy, thus increasing photochemical activity; (2) the sinking motion tends to keep locally produced precursor emissions nearer to the surface, thus limiting upward movement and dilution of the air mass; (3) ozone and its precursors, present at higher elevations (500 to 1500 meters) as a result of transport, are pushed down toward the ground; and (4) the sinking air raises the ground level pressure, generating more heat at ground level. The result is a greater supply of ozone and precursors at or near ground level, more reaction energy in the form of heat and sunlight, and relatively limited dilution in the airmass. Additionally, the clockwise airflow pattern around a high pressure system transports pollutants northward and then eastward from the industrial Midwest to the Northeast. These meteorological conditions are typically in evidence when New Hampshire monitors elevated levels of ground level ozone.

b. Diurnal Variation

27. Absent transport, ground level ozone concentrations increase during sunlight hours as a result of photochemical production and decrease substantially at night when ozone removal exceeds production (Attachment G, p. 3). However, in areas downwind of large urban regions, such as New Hampshire, ozone concentrations often rise through the evening and/or early morning hours and peak between 6:00 p.m. and 6:00 a.m. due to transport from upwind sources. *See*

Attachment H, pp. 1-2. At higher elevations, concentrations of ozone and ozone precursors may remain high at night, as there is minimal downward mixing of the atmosphere at night. *See* Attachment I, p. 3. During daylight hours when solar energy heats the ground, the resulting warm air near the ground begins to rise. Rising air creates an unstable atmospheric situation resulting in upward and downward mixing of air masses (including ozone transport layers). Thus ground level ozone concentrations rise for several hours immediately after sunrise. *See* Attachment Y, p.18.

c. Transport Mechanisms

28. The predominant transport regimes in the Northeast were observed and documented in a study conducted by the North American Research Strategy for Tropospheric Ozone - Northeast ("NARSTO/NE") entitled "Initial Results on Transport and Mixing Based on NARSTO-Northeast Data," and dated January 28, 1997. This study identified three basic flow regimes: synoptic, channeled, and near-surface. *See* Attachment I, p. 3. The synoptic flow is the pattern of air low at higher elevations (above 800 meters). Synoptic flows are unaffected by large-scale frictional ground level objects such as mountains, valleys, and lakes. Channeled flows occur at lower elevations (200 to 800 meters) where synoptic flow patterns are interrupted by large objects such as mountains, hills, and valleys but are not affected by lower, smaller objects such as trees and buildings. Near-surface flows (below 200 meters) are affected by nearly all surface frictional objects including trees and buildings. Synoptic flows are generally west-to-east, transporting pollution from the Midwest to the Northeast, while channeled flows generally follow the Appalachian Mountains southwest-to-northeast, transporting pollution from the Northeast urban corridor toward northern New England.

d. Coastline Wind Patterns

29. The Atlantic Ocean produces changes in wind directions and wind speeds along the shoreline, especially in New England. While most inland areas experience regional wind patterns with only small variations due to terrain features and other frictional effects, coastal locations are far more variable. Sea breezes develop during the heating of the day when the ground heats up, warming the onshore airmass. This airmass then rises, causing cooler air to flow in from over the ocean. Sea breezes are actually a subset of the NARSTO/NE near-surface flows that are driven by temperature differences between land and water, which also affects changes in mixing heights. Daytime sea breezes flow from the

relatively cool waters of the ocean towards the coast, and diminish over a short distance due to mixing with regional wind patterns persisting further inland and with diurnal mixing. Such sea breezes are the primary reason why high ozone concentrations occur along the New Hampshire coast, while substantially lower concentrations are recorded just a few miles further inland.

30. The graph in Attachment J, p. 1, demonstrates this typical sea breeze effect for an ozone exceedance at Rye, New Hampshire on August 1, 1995. The afternoon sea breeze shifts the wind direction to the south and east, bringing ozone from over the ocean onshore. The graph in Attachment J, p. 2, demonstrates that this meteorological dynamic operates during low ozone days as well. On July 29 and July 30, 1995, sea breezes developed suddenly shifting the wind from the northwest to the south, driving ozone concentrations upward from 40-45 ppb toward 60 ppb. The offshore ozone blown in by sea breezes appears to originate from precursors emitted in the metropolitan Boston area.

31. Offshore, just beyond the strongest coastal sea breezes, larger scale wind fields develop that may differ in direction from the inland regional wind pattern. Lower mixing heights, differing temperature gradients, and lower frictional effects cause this differential. Off the New Hampshire and Maine coasts, it is not uncommon for the over-water windfield to come from the south while the inland regional windfield is more from the southwest (*See* Attachment J, p. 3). This pattern allows transport of the ozone plume from the metropolitan Boston area to travel over the Gulf of Maine to the New Hampshire coast, even when inland wind observations suggest this should not be happening.

e. Upwind Pollution Sources and "Reservoir" Areas

32. Based on 1990 inventories, the largest stationary sources of NOx are concentrated in heavily industrialized upwind areas, particularly the Ohio River Valley (Attachment G, Figure 2). This area also experiences a large "reservoir" of ozone of persistently elevated concentrations. (Attachment G, Figure 3). Analysis performed by New Hampshire identified locations within the OTAG domain that had the most persistent levels of elevated ozone during the 1995 episode (the only episode for which adequate data was made available by OTAG). The average daily number of hours of human ozone exposure above thresholds of 60, 80, 100, and 120 ppb was identified for several OTAG runs. (Attachment T, p. 1). These plots demonstrate that unlike large source areas upwind, New Hampshire citizens

do not suffer from persistently elevated levels of ozone. Only under certain meteorological conditions when the transport of pollution from upwind sources becomes particularly efficient does New Hampshire experience high peak concentrations of ozone.

33. As recently summarized by the AQA, ground level ozone concentrations averaging 60 to 80 ppb are found throughout the summer over the OTAG domain. *See* Attachment C, p. 7. Such levels are about twice the natural background level of ozone. The highest average concentrations (as opposed to peak concentrations) and longest human exposures to elevated levels are found in and around the Ohio River Valley and the metropolitan areas of Baltimore / Washington, DC and Atlanta, (Attachment G, Figure 3). Even during summer days with the lowest ozone levels, the industrial Midwest and the Ohio River Valley experience average ozone concentrations approximately 20 ppb above natural background levels (Attachment G).

II. Evidence of Transport Into New Hampshire from Areas Within and Upwind of the Ozone Transport Region

a. NARSTO/NE Measurements

34. Aircraft measurements by NARSTO-NE (*See* Attachment I) during the ozone exceedance in July 1995 (hereinafter "July 1995 episode") demonstrate the existence of significant transport into and within the region, contributing to exceedances throughout the OTR. In separate "spiral" flights above Poughkeepsie, NY, Gettysburg, PA, and Shenandoah, VA, ozone levels above 100 ppb were recorded in the early morning (e.g., 4 a.m.), before local production of ozone could begin, on two days (Attachment G, Figures 5-6). One aircraft recorded an ozone concentration above 120 ppb at about 800 meters above Poughkeepsie on July 14, 1995, when ground level ozone was recorded at about 30 ppb. Another flight during the early morning of July 14, 1995 from Virginia to Maine recorded ozone levels in the range of 70 to 100 ppb at 500 meters elevation throughout the Northeast Corridor (Attachment G, Figure 7). Spiral flights in the afternoon over the same three cities measured uniform ozone levels from ground level to 800 meters, showing that the air had become well mixed during the day, bringing transported ozone from aloft down to the surface. An earlier flight, in the afternoon of July 8, 1995, along the entire corridor showed that ozone levels at 500 meters had risen well above 120 ppb in the Baltimore-Washington and New York metropolitan areas. At such elevations, ozone is subject to synoptic and channeled flow overnight, transporting it further downwind toward New Hampshire, where it can again be mixed down to ground level the next morning.

b. NESCAUM Analysis

35. The Northeast States for Coordinated Air Use Management ("NESCAUM") is a non-profit organization representing eight Northeastern states. These states include Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. NESCAUM's purpose is "to exchange technical information and to promote cooperation among its member states in regard to air pollution control issues of regional concern."

36. NESCAUM developed a "weight of evidence" approach to assess the transport of ozone and its precursors. This approach incorporates all available data to construct a scientifically valid composite of pollution transport. NESCAUM's report, "The Long-Range Transport of Ozone and its Precursors in

the Eastern United States," dated February, 1997, (Attachment G, p. i), identifies the principal components of the "weight of evidence" approach as follows:

i. Field measurements of ozone and its precursors;

ii. Back trajectory analyses for clean air days and high ozone days in the Northeast; and

iii. Computer modeling of pollutant emissions, weather events, and airmass chemistry leading to historically observed high ozone episodes.

37. The NESCAUM Report's key findings include the following:

i. Long range transport exists and has been clearly documented in the eastern United States;

ii. Aircraft flights (NARSTO/NE) have measured elevated transported ozone readings at night;

iii. Transported ozone from aloft mixes downward to ground level during the morning hours. Downward mixing may occur far downwind of the source regions. *See* Attachment I , p. 3 and Attachment G, Figures 6-7.

iv. During high ozone events, wind flow (i.e., pollutant transport) patterns over the northern United States are highly aligned from the Midwest to the Northeast. *See* Attachment G, Figure 1.

v. Ozone production on a regional basis is limited by NOx emissions.

vi. NOx emissions from the industrial Midwest are vastly greater than those from the Northeast, a disparity that will increase as the Northeast continues to reduce emissions under the OTC NOx MOU. *See* Attachment G, Figure 2. (OTAG 1990 inventory data for generating facilities in OTAG Subregions 1-7 shows that New Hampshire emissions comprise less than 1%, and emissions in the entire OTR comprise only about 29%.)

vii. Back trajectory analyses of airmass movements for the most severe

ozone days in the eastern United States indicate transported pollution from the industrial Midwest. *See* Attachment G, Figure 8. Similar analyses regarding clean air days in the Northeast show airmasses originating in Canada. *See* Attachment G, Figure 9.

viii. Computer modeling performed by OTAG is consistent with measured ozone levels and back trajectory analyses in showing significant impact from transported ozone from the industrial Midwest into the Northeast. *See* Attachment G, Figure 10, and Attachment G, Figure 11.

ix. Cost effective NOx reductions can be readily made in the industrial Midwest and would be especially beneficial to the Northeast.

c. OTAG Conclusions

38. OTAG was created to "identify and recommend a strategy to reduce transported ozone and its precursors which, in combination with other measures, will enable attainment and maintenance of the national ambient ozone standard in the OTAG region." OTAG, Final Recommendations, June 1997 (Attachment B, p. 1). OTAG consisted of 37 states and hundreds of stakeholders, and it conducted the most comprehensive modeling and analysis of ozone transport performed to date.

39. OTAG's final conclusions on ozone transport are clear:

"Air quality data documents the widespread and pervasive nature of ozone and indicates transport of ozone. Air quality analyses also indicate that ozone aloft is carried over and transported from one day to the next. Generally, the range of transport is longer in the North than in the South." OTAG Final Recommendations, Major Modeling/Air Quality Conclusions (Regional and Urban Scale Modeling Workgroup), Attachment B, p. 1.

40. The OTAG AQA concluded that ozone transport may range from zero to over 500 miles, based on direct observations and statistical analyses correlating regional patterns with meteorological factors. OTAG modeling results, particularly subregional modeling, support this scale of transport, and showed that

emissions in some subregions of the domain, particularly in the Midwest, affect ozone concentrations far downwind in many other areas of the domain.

41. The UAM-V model used for the OTAG analyses has been shown to underpredict ozone transport, thus the actual upper end of the range of transport is likely to be somewhat greater than 500 miles and the concentrations of ozone transported are likely to be somewhat higher than the modeling shows. *See* The OTAG AQA Workgroup Final Report, "Telling the Ozone Story with Data," Attachment C, p. 4, and "Critique of OTAG Model Performance Related to Ozone Transport into the Northeast," April 16, 1997, Attachment K, p. 4. Additionally, EarthTech's March 1997 UAM-V model performance study found that underprediction of ozone transport by the UAM-V model resulted from a bias of daily maximum concentrations compared with morning ozone concentrations aloft. *See* Attachment W, pp. ES-1. The UAM-V model underpredicted morning ozone aloft by about 10 ppb, resulting in a net decrease in ozone transport to downwind locations. *See* Attachment X, p. iv. Thus, the magnitude of ozone transport into New Hampshire is probably understated in OTAG modeling.

42. The OTAG Regional and Urban Scale Modeling ("RUSM") workgroup concluded that regional NOx reductions are effective in producing regional ozone benefits; the more NOx reduced, the greater the ozone benefit. In addition, careful examination of OTAG modeling evidence indicates that, in general, ozone benefits accelerate with incremental NOx reductions (i.e., ozone benefit as a function of NOx reduction is non-linear). *See* Attachment Z. Most analyses which belittle the relatively small ozone reductions modeled as a result of initial NOx reductions in NOx-saturated airsheds (e.g., 2-6 ppb) are inherently flawed because they do not recognize this non-linear character. *See* Attachment AC. VOC controls were shown to be substantially less beneficial and primarily limited to urban areas. The OTAG Policy Group recommended that a range of NOx controls be applied to generating facilities in the fine grid portion of the OTAG domain up to an 85% reduction or an emission rate of 0.15 lb/mmBtu.

43. These conclusions were developed through extensive modeling using "state-of-the-art" photochemical models and data bases for simulating the physical and chemical processes involved in the formation and transport of ozone and precursor species over multi-day episodes and regional scales. (OTAG Final Recommendations, OTAG's Technical Analysis, Attachment B, p. 1.) In short, OTAG modeling and its derivative analyses provide the most complete,

scientifically credible tools and data available for the assessment of interstate transport.

44. Based on its analysis of the data, OTAG AQA determined that three out of the four widespread ozone episodes chosen for OTAG modeling were characterized by similar meteorological characteristics. The episodes begin with several days of stagnation over the Midwest followed by strong and persistent westerly or southwesterly winds, carrying built-up ozone from the Midwest into the Northeast. *See* Attachment G.

45. Back trajectory frequency analyses presented by Poirot and others to OTAG concluded that the cleanest airmasses originate in Canada and northern New England (Maine, New Hampshire, Vermont, and northeastern New York) *See* Attachment C, Figure 12a. The most polluted airmasses originate in a region that is approximately outlined by Chicago, St. Louis, Memphis, Washington, DC, and Boston. This region includes the industrial midwest and most of the Ozone Transport Region. *See* Attachment C, Figure 12b.

46. A report presented to OTAG by Husar and Renard, "Ozone as a Function of Local Wind Direction and Wind Speed: Evidence of Local and Regional Transport," Attachment L, p. 29, which supports the OTAG AQA recommendations, states:

> *"The Boston, MA metropolitan area shows virtually no dependence of ozone concentration on wind speed, except during northeasterly winds. The lack of wind speed dependence clearly indicates that the average concentration in Boston is dominated by transport and that the local contributions to the average are virtually undetectable. Directionally, southwesterly winds are the highest at 70 ppb, and northeasterly transport brings lowest ozone concentrations at about 45 ppb."*

If ozone concentrations in the metropolitan Boston area are dominated by transport, then it follows that the impact of transport is even more dominant in areas that are proximate to, downwind of, and have lower emissions than metropolitan Boston itself, such as New Hampshire.

d. <u>Ozone Contribution Analyses Based on OTAG Data</u>

(i). Culpability Analysis

47. New Hampshire conducted a thorough analysis of grid cell by grid cell, hour by hour data for the approximately 35,000 grid cells for OTAG's modeling of the 1995 episode. *See* " Apportioning Relative Ozone Culpability," Attachment M and "Assessment and Apportionment of Ozone Culpability," Attachment N. Through this analysis, an "ozone response curve" was developed which correlates ozone impacts directly with NOx emission control levels in the various OTAG subregions.

48. "Culpability analysis" uses this ozone response curve to assign relative responsibility to upwind source regions for downwind transport concentrations. A further description of the scientific basis of this analysis appears in Attachment N. New Hampshire believes that culpability analysis provides the best available evidence that the generating facilities contribute significantly to the transport of ozone and ozone precursors to New Hampshire.

49. Culpability analysis using OTAG subregional zero-out run data was performed for the July 10-18, 1995 ozone episode, which shows exceedances of the NAAQS in New Hampshire. Plots reflecting percent culpability appear in Attachment O. It is clear from these plots that ozone and its precursors can contribute to downwind ozone levels over distances as far as 1000 miles from emission sources. In addition, these plots show that the entire OTAG domain is subject to regional ozone transport to a significant extent, ranging from 20% to over 70% in some areas. It is noteworthy that at least 20% of the ozone in each OTAG subregion appears to be produced outside of the subregion. In other words, to a greater or lesser extent, all OTAG subregions both contribute to and are recipients of significant regional ozone transport.

50. The results of New Hampshire's culpability analysis for the fine grid OTAG Subregions which contribute more than 5% to New Hampshire's ozone concentrations are as follows:

OTAG Subregion	General Description of OTAG Subregion	Culpability from OTAG Subregion to New Hampshire
1	Southern half of Wisconsin, Northern half of Illinois, Parts of Indiana, Iowa, Michigan.	5 to 10%
2	Southern half of Michigan, Northern half of Ohio, Part of Indiana.	5 to 20%
3	Most of Pennsylvania, Western half of New York.	30 to 50%
4	All of New Jersey, Delaware, Connecticut, Part of eastern Pennsylvania, Metropolitan New York City.	10 to 30%
5	Southern half of Illinois, Eastern Missouri, Western Kentucky, Southern Indiana.	Up to 10%
6	Southern half of Ohio, Eastern half of Kentucky, Western half of West Virginia, Parts of Indiana and Virginia.	Up to 10%
7	All of Maryland, Most of Virginia, Eastern half of West Virginia.	Up to 10%

(ii). Other Studies

51. Independent analyses corroborate the conclusions reached through culpability analysis. Rao, Mount and Dorris, for example, employ a different quantitative approach to assign relative geographic responsibility for downwind

ozone levels, and incorporate economic modeling to determine a possible least cost control strategy for providing adequate regionwide ozone reductions. Their conclusions, which were derived through many UAM-V modeling runs and produced statistically significant correlations, are quite similar to those determined through culpability analysis. See Attachment P, "Alternative Strategies for Reducing Ozone in OTAG: Who Contributes and Who Should Control Emissions," and Attachment Q, "Least Cost Options for Ozone Improvement in the Eastern United States, Estimating Emission Weights."

52. A study performed by Dr. Paul Miller of NESCAUM (Attachment U), estimated the incremental contribution of emissions in Subregion 6 to ozone concentrations downwind based on the duration and spatial extent of an exceedance at selected locations in the OTR in the base case. Subregion 6 emissions were zeroed out on each day of the July 1995 episode and multiplied by the length in hours of the exceedance and its area in square kilometers. Comparison of these calculations shows that zeroing out Subregion 6 reduced overall exposure during the episode by over 12% in New England, over 16% in New York, over 43% in Baltimore and over 41% in Philadelphia. The effect varied from day to day, with the largest absolute decrease occurring in New England on July 14, 1995. This study provides additional evidence of the magnitude of ozone transport in the northern part of the OTAG domain, however it lacks the ability to handle the empirically established non-linear nature of ozone reduction as a function of NOx reduction. New Hampshire's culpability routine is designed to overcome this shortcoming. The same analysis using culpability for Subregion 6 for the July 1995 episode yields 2 to 15% culpability in New England, 5 to 20% in New York, 10 to 30% in Baltimore, and 10 to 20% in Philadelphia (Attachment O, p. 1).

e. Mt. Washington Monitoring Data

53. Mt. Washington in Pinkham Notch, New Hampshire, is tall enough (6288 feet) to reach well up into the upper ozone transport layers with minimal obstruction by other terrain features. Ozone levels recorded at the summit monitor are consistent with NARSTO findings, showing consistently elevated levels of ozone with little diurnal variation during most episodes – clear evidence of long range transport. Attachment R , p.1, contains summarized monitoring data from the summit, and from Camp Dodge located near the base of the mountain. As further evidence of long range transport, Camp Dodge often records lower ozone concentrations than those seen contemporaneously at the summit.

54. Both monitors have no major NOx sources within 75 miles, and no major sources upwind in the direction of prevailing winds for approximately 150 miles. Transport from more distant upwind sources is the primary source of ozone monitored at these sites. Since the summit of Mt. Washington is located within the transport elevations, downward mixing is not a factor in creating the peak ozone values it experiences. In fact, transport time from upwind source areas is the single largest factor in determining the hour of maxima at the summit. Daily maximum ozone levels at Camp Dodge are dependent on inversion breakup during daily downward mixing from upper transport elevations, and thus are typically recorded during the afternoon hours. On the contrary, summit maxima show a stronger preference for the overnight hours, when no ozone is produced locally. *See* Attachment R, p. 2. The percent share of daily one-hour ozone maxima that occur during daylight heating hours and outside of daylight heating hours on the summit of Mt. Washington and at Camp Dodge are listed in the table below. (Daylight heating hours are hours of the day when solar energy drives vertical mixing of transport layers.)

Mt. Washington Monitor Location	Percent of Maxima During Daylight Heating Hours (9 a.m. to 5 p.m.)	Percent of Maxima Outside of Daylight Heating Hours (6 p.m. to 8 a.m.)
Summit	18%	82%
Base (Camp Dodge)	80%	20%

f. Photochemical Modeling Performed by Massachusetts

55. Modeling performed by the Commonwealth of Massachusetts of the July 1988 episode using the UAM-IV model shows exceedances of the NAAQS in Connecticut, Rhode Island, and Massachusetts in 1999 even when all anthropogenic NOx and VOC emissions in New England are set to zero. Thus, attainment will not be possible in southern portions of New England without substantial reductions in ozone transport from upwind areas. Under these circumstances, any measurable contribution to ozone nonattainment from upwind regions must be considered significant.

56. In additional modeling performed for the same 1988 episode by Massachusetts, New Hampshire's anthropogenic VOC emissions were reduced to zero. The results indicated that even these extreme VOC emission reductions would yield marginal ozone benefit, leaving the State far short of achieving attainment. (*See* Attachment V). Furthermore, the model used to perform this modeling (UAM-IV) contained a major flaw in its handling of VOC chemistry and in the development of biogenic VOC emissions, which substantially overstated ozone reactivity to VOC emission changes. As a result, the ozone reductions which can be expected from VOC reductions in New Hampshire are insignificant. This conclusion concurs with OTAG modeling of Round 3 Run I, IN60, and IV60 difference plots (Attachment S). Exposure plots (Attachment T, pp. 3-5) show very little improvement from Run I with an additional 60% VOC emission reduction, but substantial improvement with continuing NOx reductions. These modeling runs clearly demonstrate that NOx is the limiting precursor in controlling regional ozone.

III. Identification of Sources Which Significantly Contribute to Transport of Pollution Into New Hampshire

57. The State of New Hampshire alleges that those sources and groups of sources which emit 10 tons per day or more of NOx that are situated upwind of New Hampshire in the OTR and in geographic Subregions 1-7 of the OTAG domain contribute significantly to nonattainment, and/or interfere with maintenance of attainment, of the NAAQS for ozone in the State. In order to identify examples of such sources or groups of sources, New Hampshire has in this petition listed those sources or groups of sources which are situated: (1) within the OTR upwind of New Hampshire, and/or (2) in geographic subregions of the OTAG domain which have been shown through culpability analysis to contribute 5% or more to ozone in New Hampshire. The State has employed 5% by way of illustration, not as a reflection that this percentage of contribution represents a minimum threshold for determining a “significant contribution.” As noted previously, it is the Petitioner’s position that any contribution of transported ozone into an affected state must be considered significant.

58. In identifying the sources and groups of sources cited in Attachment A, Petitioner applied these criteria to the OTAG Plume-in-Grid source file, 1990 inventory. The OTAG inventory file was used because of its acceptance in the OTAG modeling process and because the inventories were checked and updated by each individual OTAG state. This inventory purports to include all OTAG

elevated NOx sources with facility-wide emissions of 10 tons per day or more. Other, more recent compilations of NOx emissions sources (e.g., from EPA's Acid Rain Division) could also have been employed and should be considered by EPA in making its finding. As indicated earlier, any omission of sources or groups of sources from this list is unintentional, as all such sources are intended to be included in this petition.

59. Due to the limited hourly ozone concentration data made available for public analysis by OTAG, New Hampshire's culpability analysis could be conducted only for the 1995 episode. Thus, while New Hampshire has identified generating facilities which contributed significantly to transport into the state during this episode, these facilities may not represent all of the sources and groups of sources located in other OTAG subregions which may contribute significantly to transport of ozone into New Hampshire under different meteorological conditions in other ozone episodes. For example, while generating facilities to the south of subregions 5, 6, and 7 did not appear to contribute significantly to ozone in New Hampshire during the 1995 episode, the geographic extent of emissions from NOx sources or groups of sources in OTAG Subregions 8 and 9 in this episode was sufficient to reach New Hampshire had meteorological conditions been slightly different. In addition, while the limited set of episodes considered during the OTAG process may have been adequate to conclude that high ozone days in the Southeast are characterized by stagnation in that region, it does not follow that the contribution of the Southeast to high ozone days in the Northeast is insignificant.

60. Furthermore, OTAG data suggests that over distances of approximately 100 to 150 miles, concentrations of ozone in the Northeast are reduced by half (i.e., a "half-distance" applies which is similar to the concept of "half-life" in radioactivity). Using this approach, Petitioner has determined that ozone and NOx can be transported more than 600 miles while retaining more than 6% of their original impact. Such contributions from distant sources could easily move New Hampshire from nonattainment to attainment. For example, generating facilities located 750 miles upwind and emitting 320 tons of NOx per day can provide equivalent pollutant impact to facilities emitting 10 ton of NOx per day located less than 150 miles upwind of New Hampshire.

61. Applying the "half-distance" concept to generating facility emissions focuses primarily on a large number of nearby sources or groups of

sources, adding more distant ones as they exceed greater "half-distance" emission thresholds. For each concentric "half-distance" one moves upwind, sources or groups of sources of twice the size have the same downwind ozone impact. This dynamic is illustrated in the table below. While this approach is based on generating facilities which emit 10 tons or more of NOx per day, the collective transport impact of facilities with lesser emissions can not be ignored and must be considered by the Administrator in evaluating relief granted under this petition.

Half-Distance Range (miles)	Facility NOx Emissions (tons/day)
0-150	10
150-300	20
300-450	40
450-600	80
600-750	160
750-900	320

The work of Rao, Mount, and Dorris (Attachment Q) confirms that generating facilities or groups of facilities at the far distances shown in this table must be considered significant. Their analyses indicate that elevated NOx emissions from "Band III" (which includes sources or groups of sources in OTAG Subregions 8 and 9) produce statistically significant contributions to Northeast ozone at 10 to 65% of the impact of NOx emitted locally in the Northeast.

62. These scientifically-based distances and source sizes compel the Administrator to conclude that sources and groups of sources situated in OTAG subregions beyond those identified in this petition could, and most likely do, contribute significantly to the transport of ozone into New Hampshire under meteorological conditions that vary from those considered formally by OTAG.

G. Determination of Significant Contribution Under Section 126(b)

63. In the petitions brought under Section 126 to date, the Administrator has not found a violation of the Section 110 prohibition. However, prior decisions by EPA under Section 126 provide some guidance in determining when a source or group of sources is contributing significantly to nonattainment in a downwind State. Rejecting a "bright-line" test, EPA has emphasized the need to apply a series of factors in determining significant contribution. In the agency's proposed notice of denial of a Section 126 petition brought by Jefferson County, Kentucky against an electric generating plant in Indiana, EPA advanced three criteria "used by the Administrator in making … determinations under Section 126." 46 Fed. Reg. 38, 937-39 (July 30, 1981). These criteria are:

i. a demonstration establishing the existence and geographic boundaries of the nonattainment or PSD area which is the subject of the petition;

ii. a demonstration that achievement of ambient air quality standards, or of measures necessary to prevent significant deterioration or to protect visibility, is prevented by the named out-of-state sources; and

iii. indications that sources within the petitioning states which impact on the PSD and nonattainment areas have been adequately controlled.

Air Pollution Control District of Jefferson County, Kentucky v. EPA, 739 F. 2d 1071, 1078 (6th Cir. 1984) ("Jefferson County").

64. Four years later, in 1988, the Administrator relied upon four (4) criteria in denying Section 126 petitions brought by Maine, New York, and Pennsylvania against specific sources in several midwestern and southern states for excessive sulfur dioxide and particulate matter emissions. *See* State of New York v. EPA, 852 F. 2d 574,577 (2nd Cir. 1988). While articulated in somewhat different language, these criteria mirrored the 1981 criteria, although the "balancing of equities" with downwind controls was omitted. The State of New Hampshire believes strongly that equitable considerations remain crucial to the

Administrator's evaluation of the effect of transported ozone from the OTAG states into the Northeast.

65. In evaluating the present petition, the Administrator must apply these criteria, and possibly others, in a manner which reflects the legislative amendments to Sections 110 and 126 of the CAA in the time since the sulfur dioxide petitions in the 1980's, as well as the important photochemical differences between the transport of sulfur dioxide and of ozone.

66. Prior to the 1990 amendment of the CAA, Section 126 authorized the filing of a petition against a "major source" of air pollution. Clean Air Act Amendments of 1977, Pub. L. No. 95-95, §126, 91 Stat. at 724. The 1990 Amendments now authorize states to maintain an action against a major source or "group of stationary sources." 42 U.S. §7416(b). This change strongly supports the conclusion that Congress recognized the reality that a large number of sources can together produce a significant contribution to nonattainment in another state, even if they would not do so individually. Wilcox, New England and The Challenge of Interstate Ozone Pollution Under the Clean Air Act of 1990, (24 Boston College Env. Affairs Law Rev. 1, 33 (1996)). Indeed, in enacting the 1990 amendments, Congress was fully cognizant of the problems posed by the transport of pollution. Id. (citing H.R. Rep. No. 490, 101st. Cong., 2d Sess. 202).

67. Section 110, like Section 126, underwent revision in 1990, which New Hampshire believes enlarged the duty of upwind states to prevent the transport of pollution. First, former Section 110 (a)(2)(E) was expanded to prohibit any source or other type of emissions activity, rather than simply any stationary source, from causing or contributing to nonattainment in another region. Compare Clean Air Act Amendments of 1977, Pub. L. No. 95-95, §108, 91 Stat. at 693 with 42 U.S.C. §7410(a)(2)(D). In contrast to the prior version of Section 110, this amendment ensures that EPA must consider emissions from any source or group of sources when assessing the impacts of transported pollution. *See* Wilcox, supra, at 31. *See also* State of New York v. U.S. EPA, 716 F. 2d 440, 442 (7th Cir. 1983)(EPA not required to consider cumulative impact of sulfur dioxide emissions when evaluating revision of SIP); State of New York v. Administrator, EPA, 710 F. 2d 1200, 1203-04 (6th Cir. 1983)(EPA not required to consider cumulative impact of emissions from all New York State utilities in reviewing SIP amendment affecting a particular source); State of Connecticut v. U.S. EPA, 656 F. 2d 902,909 (2nd Cir. 1981)(For purposes of a revision

application under Section 110(a)(3)(A), proper inquiry is directed to emissions of a particular source of pollution).

68. Secondly, Section 110(a)(2)(D)(i)(I) now expressly permits EPA to consider emissions that "contribute significantly" to nonattainment in another state. Although the CAA neither defines this term nor provides any guidance regarding the precise amount of cross-boundary pollution required to violate this standard, it represents a more restrictive standard than that contained in the 1977 CAA. Wilcox, infra, at 31. (citing Clean Air Act Amendments of 1977, Pub. L. No. 95-95, §108, 91 Stat. at 693. (requiring state SIPs to contain provisions "prohibiting any stationary source within the State from emitting any air pollutant *in amounts* which will … prevent attainment or maintenance by any other State …") (*emphasis added*). Among other criteria that EPA must consider in determining whether ozone and/or ozone precursors transported from upwind sources or groups of sources "contribute significantly" are (i) the results of a comprehensive analysis of the underlying ozone impact of NOx emissions, such as culpability analysis, which analysis adequately incorporates the non-linear nature of achieving ozone reductions, rather than simple, superficial "ppb" comparisons; and (ii) the relative cost of controls on upwind sources compared to the cost of additional controls in the Petitioner's State and the cost of controls on other upwind sources, specifically in terms of ozone benefit expected for the control costs incurred. *See* Attachment AB, p. 4. Inasmuch as "contribution" in this matter relates to shared or partial responsibility, and "significance" regards meaningfulness or importance, there is a parallel construction between (1) importance/significance (on a per ton basis) and distance, and (2) responsibility/contribution and cost. Consistent with the half-distance concept introduced above, importance/significance per ton of NOx emitted diminishes with distance. However, since pollution control costs are subject to diminishing returns, allocating responsibility/contribution according to relative cost to control allows least-cost solutions to be determined. The product of a distance component (i.e., effectiveness) and a responsibility/contribution component (i.e., relative cost) produces a measure of relative cost-effectiveness which provides a reasonable composite index of the relative significance of each jurisdiction's contribution.

69. The important distinctions in the physical and photochemical properties of sulfur dioxide ("SO2") and ozone also compel EPA to modify the criteria it applied for determining "significant contribution" in prior Section 126 petitions. Ozone is produced by complex reactions between NOx and VOCs, which are themselves emitted by innumerable sources, large and small, stationary

and mobile. This distinction demands a different analytical approach to the determination of whether out-of-state sources are contributing to ozone nonattainment or preventing maintenance in a downwind region. For example, in Jefferson County, supra, the Sixth Circuit Court of Appeals upheld EPA's determination that SO2 emissions from a single power plant in Indiana would not contribute "substantially" to nonattainment in the downwind region where such emissions would account for 3% of the pollutants in the nonattainment region. However, while EPA may have considered a 3% SO2 emission contribution insignificant in Jefferson County, that amount of ozone contribution would bring New Hampshire approximately half-way to attainment.

70. Further, EPA's own analysis of the OTC Low Emission Vehicle ("OTC LEV") proposal implies that because large regionwide reductions of emissions of NOx and VOCs are necessary (though not sufficient) to enable serious and severe nonattainment areas to attain the NAAQS for ozone, and because such reductions could not be achieved by controls on any individual source or group of sources, all emissions which could be controlled through application of reasonable and practical control measures should be considered to contribute significantly to nonattainment, even though the emissions from individual sources might be quite small. *See* Supplemental Notice of Proposed Rulemaking, 59 Fed. Reg. 48664, 48682-84 (September 22, 1994). In the context of ozone, where modeling may indicate that a state cannot attain the NAAQS even if it zeros out all anthropogenic emissions, every contribution, however small, by any source or group of sources, must be considered significant.

71. EPA's criteria for determining "significant contribution" for ozone transport under this petition must also reflect the improved analytical tools for demonstrating transport than existed two decades ago when EPA was required to review the SO2 petitions brought under Section 126. *See, e.g.* State of New York v Administrator, U.S. EPA, 710 F. 2d 1200, 1204 (6th Cir. 1983) (EPA did not act arbitrarily in failing to analyze impact of emissions more than 50 kilometers from plant where the selected reference model was not accurate at greater distances). Today, OTAG and the OTC LEV proceedings have developed and demonstrated vastly more accurate techniques and methodologies for establishing ozone transport and upwind contribution.

72. A recent articulation of EPA's analytical framework to be used in determining what constitutes "significant contribution" to downwind nonattainment is set forth in an April 1997 staff report:

> There are no established criteria for determining whether emissions in one State make a significant contribution to downwind nonattainment. Whether a contribution is "significant" depends on the overall context. There may be no single amount of contribution which could be considered as a "bright-line" indicator of "significant" that would be applicable and appropriate in all circumstances. Factors to be considered in determining whether a contribution is significant include: (i) the level of emissions in the area upwind of a nonattainment area, (ii) the amount of local contribution in the downwind nonattainment area, (iii) the transport distance between the upwind source area and the downwind problem area, and (iv) the amount of contribution (ppb above the level of the current standard).

EPA Staff Report: Preliminary Assessment of States Making a Significant Contribution to Downwind Ozone Nonattainment C.3, at 22-23 (April 1997) ("EPA Preliminary Assessment").

73. Indeed, EPA's Preliminary Assessment recognizes the complex regional nature of pollution transport, particularly in its evaluation of OTAG subregions 1-12:

> A source or group of sources should not be exempted from treatment as a significant contributor merely because it maybe a small part -- in terms of total emissions -- of the overall problem, when all or most other contributors, individually, are also relatively small parts of the overall problem. This situation, in which a number of individual (and sometimes small) sources collectively cause a significant impact, is a major aspect of the contribution issue. The moderate-to-high ozone levels which cover broad regions are the result of emissions from millions of individual sources interacting over multiple days. The contribution to downwind nonattainment results from the cumulative contribution from all sources involved in this process. In this

> regard, the OTAG modeling was not performed on a single source basis, or even a single State basis …. This set of models was chosen since it provides an appropriate way to quantify the contribution of the full set of anthropogenic emissions in one area to ozone concentrations in another.

Id. §C.3, at 23.

74. Congress, in the CAA, requires EPA to evaluate all emissions in a contributing region as "significant" in fashioning relief under Section 110. However, under Section 126, a petition must focus on specific "major sources or groups of stationary sources." Thus, the State of New Hampshire specifically requests relief in this petition with respect to generating facilities and industrial boilers in the States of the OTR and in the States or portions of States located within OTAG Subregions 1 through 7. These sources contribute significantly to ozone nonattainment and interfere significantly with maintenance in the OTR, including specifically in New Hampshire.

H. CONCLUSION

75. For the foregoing reasons, the Administrator should find that the generating facilities are emitting air pollutants in violation of §§ 110(a)(2)(D) and 126(c) of the CAA, and should establish emission limitations for the generating facilities at levels at least as stringent as those established under the OTC MOU and the OTAG Final Recommendations, to prevent such facilities from contributing significantly to pollution in Petitioner's state. Under the same authority, the Administrator should establish a compliance schedule (including increments of progress) to ensure that the generating facilities comply with the emission limitations as expeditiously as possible.

Respectfully submitted,

THE STATE OF NEW HAMPSHIRE

_____
Robert W. Varney, Commissioner
Department of Environmental Services

_____
Philip T. McLaughlin
Attorney General

Dated: _____